Remarks

Claims 29, 32, and 34-57 are pending. Claims 37 and 43-53 have been withdrawn from consideration. Claim 55 has been canceled. Claims 32, 38, 39 and 54 have been amended. Basis for the amendment to claim 39 is at specification page 7, line 7 – page 8, line 2.

The amendment to the specification at page 15 overcomes the objection stated in Office Action part 1.

Claims 38, 39, 42, and 54-57 stand rejected under 35 USC § 102(b) as being anticipated by WO 00/44472 (Insley et al.; US 6,280,824). This rejection is traversed as to claim 38; has been avoided as to claim 39 (which has been made dependent from claim 32) and is moot as to claim 55, which has been canceled.

Attached to this amendment are two tables comparing certain elements in the claims in the present application with the disclosures of the references cited against the claims. The undersigned attorney has studied the references, and if a listed element of the present claims was found in a reference, it was noted by its location in the reference in the table. A blank space in a table corresponding to a claim element indicates that no disclosure of that claim element was found in the reference. The tables are a convenient summary of the differences between the pending claims and the references. The abbreviated descriptions of the claim elements are for purposes of convenient presentation in the tables and do not change the actual claim language or scope.

As shown in the first attached comparison table, Insley does not have the following features of the rejected claims:

1. at least one gas permeable, water impermeable layer which is required by all rejected claims;

2. at least one microbial support layer on the gas permeable, water impermeable layer, said microbial support layer being hydrophilic, as required by claim 54; and

3. the microbial support layer being made hydrophilic by a means listed in amended claim 54.

The Examiner pointed out that the Insley filtration media has a cap layer made of a non-woven fabric, which would be porous (Office Action p.3). However, the cap layer of Insley is not water impermeable. Normally, non-wovens are water permeable, and there is no reason to believe that Insley's non-woven cap layer is not water permeable, since he is using it in an air filtration

medium which is not immersed in water or exposed to a stream of liquid water. There would be no reason requiring that Insley's media cap layer be made water impermeable. Thus, Insley's cap could not function as the gas permeable, water impermeable layer of the rejected claims.

In addition, Insley's cap layer is placed over the filtration media array 30, not on a gas permeable, water impermeable layer, as required of the microbial support layer in rejected claim 54. Therefore, Insley's cap would not function as a microbial support layer.

At the top of Office Action page 3, the Examiner has referenced Insley's use of certain fillers (e.g., activated carbon) in his filter layer. However, that does not anticipate the fillers in claim 56, because they are in the claimed microbial support layer, which does not exist in Insley. There is no desire to make the gas permeable, water impermeable layer of the present invention hydrophilic, since that might tend to "flood" the membrane aerated biofilm reactors for which the claimed layered sheet constructions are intended. It is the microbial support layer that is intended to be hydrophilic.

At Office Action page 3, lines 3-5, the Examiner said that Insley's filter layer has been rendered hydrophilic by exposure to electron beam radiation (column 7, lines 12-15). This assertion by the Examiner is traversed. Although ionizing radiation (which can include electron beam) is mentioned, Insley does not specify e-beam, and there are other types of ionizing radiation. In addition, the ionizing radiation in the cited passage of Insley is for the purpose of graft polymerization of monomers onto polypropylene, not for the purpose of making a surface hydrophilic. There is no indication in Insley that the ionizing radiation renders the polymer hydrophilic.

In the sentence bridging Office Action pages 2 and 3, the Examiner has made reference to Insley column 8, lines 40-45 where he describes combining his filtration media array with other filtering material such as nonwoven fibrous material. However, such added material is not described as a microbial support layer, and it would not function as such a layer. It is described by Insley as an additional layer to an air filter to facilitate such things as handling, mounting, assembly or use (col. 8, lines 42-46). The microbial support layer of claim 54 is for the purpose of growing a population of microbes (e.g., in a membrane aerated biofilm reactor). Claim 54, as amended incorporates the limitations of claim 55 that the microbial support layer is made hydrophilic by one

of four specified means, such as grafting hydrophilic polymer chains. None of these means (i)-iv)) for making a microbial support layer hydrophilic are disclosed in Insley.

In view of the above recited differences, Insley does not disclose all the features of claims 38, 42, 54, 56 or 57, and they are novel over Insley.

Claims 40 and 41 stand rejected under 35 USC § 103(a) as being unpatentable over WO 00/44472 (Insley et al.; US 6,280,824) in view of US 6,153,097 (Jensvold et al.). This rejection is traversed.

Jensvold discloses micro-porous membranes used in gas delivery, but there are substantial reasons why Jensvold combined with Insley does not make claims 40 and 41 obvious. As discussed above, and as shown in the first attached comparison table, there is no disclosure in the references of a gas permeable, water impermeable layer in conjunction with a gas delivery layer.

Secondly, contrary to the Examiner's first two sentences at the top of Office Action page 4, there is no expectation of successfully practicing the invention of U.S. '824 in combination with Jensvold. Jensvold is a teaching regarding gas separation membranes and devices. There is no reason to combine Jensvold with Insley (a patent on air filters, Insley col. 9, ll. 38-44) which are intended to separate particulates from air. Jensvold's teaching is about separating gases from a mixture of different gases (col. 12, ll. 19-31). There is no reason to expect that a microporous membrane taught for use in Jensvold's gas separation device would function in Insley's air filter. The purpose of the gas delivery layer of rejected claims 40 and 41 is to deliver gas (e.g., air) to the gas permeable, water impermeable layer. Even if one accepted the Examiner's assertion of a suggestion to modify Insley in view of Jensvold, there is nothing in either to teach one to combine a porous, foam, woven or non-woven fabric membrane with a gas permeable, water impermeable layer which is required by claims 40 and 41. Thirdly, there is no disclosure in either Insley or Jensvold of the foams, woven or non-woven fabric required in claim 41.

In view of the claim limitations missing from both references and the lack of a reason to combine Jensvold and Insley '824 and further modify their disclosures, claims 40 and 41 are not obvious. No reason exists in the art cited for one to lift the microporous membranes from Jensvold's gas separation devices and place them in the filter structure taught by Insley. A *prima facie* case of obviousness has not been established.

Claims 29, 36, and 54 stand rejected under 35 USC § 102(b) as being anticipated by, or in the alternative, under 35 USC § 103(a) as obvious over WO 99/65595 (Insley; US 6,514,412). This rejection is traversed as to claims 29 and 36 and is avoided as to amended claim 54.

Despite the discussion at Office Action pages 4-5, there remain substantial differences between the rejected claims and Insley '412. First Insley does not disclose the gas permeable water impermeable layer comprising a microporous layer coated with a gas permeable polymeric coating, as required in claim 29.

The Examiner argues at the bottom of Office Action page 5 that Insley's disclosure of separation media made of the same or different materials reads on the gas permeable, water impermeable layer of claim 29. This assertion by the Examiner is specifically traversed. The disclosure of separation media made of a number of types of materials is not the same as the microporous layer of rejected claim 29 coated with gas permeable polymeric coating. Such a layer is not expressly disclosed in Insley, and it has not been established that all microporous films are gas permeable and water impermeable.

As to claim 36, Insley is missing disclosure of a microbial population on a gas permeable water impermeable layer.

As to amended claim 54, which now incorporates the limitations formerly in claim 55, Insley, fails to disclose the required hydrophilic microbial support layer on the gas permeable, water impermeable layer, and also fails to disclose the means (i)-iv)) for making the microbial support layer hydrophilic.

Insley '412 teaches a microporous separation device. The layered sheet construction of claims 29, 36, and 54 is a device for growing bacterial populations on membranes for wastewater treatment. In order to arrive at claims 29, 36 and 54 from the disclosure of Insley '412, one would have to modify Insley '412 by: specifying gas permeable, water impermeable microporous film having a gas permeable polymeric coating; adding a microbial population to the surface of the gas permeable, water impermeable layer; and adding a hydrophilic microbial support layer on the gas permeable, water impermeable layer (said microbial support layer characterized by having one of the means (i-iv) specified in claim 54); and all of these modifications would have to be without any incentive from Insley to make them. Hindsight, with

the advantage of knowing the present applicants' work, would be necessary to make such modifications.

Claim 34 stands rejected under 35 USC § 103(a) as being unpatentable over WO 99/65595 (Insley; US 6,280,824) in view of US 4,333,779 (Rinker et al.). This rejection is traversed.

The reasoning supporting the unobviousness of claim 29 above applies to claim 34, since it depends from claim 29. Even if one conceded that it is within the skill of the art to increase the surface area of filtration media per unit volume by corrugating the media, and the same principle would apply to membrane aerated bioreactor media, the obviousness of claim 29 would not be established. The cited art combination is still missing a gas permeable water impermeable layer comprising a microporous layer coated with a gas permeable polymeric coating. The Examiner has not pointed to any disclosure of such membranes in Insley or Rinker.

Claim 35 stands rejected under 35 USC § 103(a) as being unpatentable over WO 99/65595 (Insley; US 6,280,824) in view of US 6,558,549 (Cote et al.). This rejection is traversed.

Cote discloses a spiral configuration for a biofilm membrane, but the combination of Cote with Insley '824 is deficient in missing the gas permeable, water impermeable layer comprising a microporous layer coated with a gas permeable polymeric coating, as required by claim 29 from which claim 35 depends.

Claims 29-31, 33, 36, and 54 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-19 of US 6,514,412. This rejection is traversed as to claims 29 and 36, it is moot as to canceled claims 30-31 and 33, and it has been avoided as to amended claim 54.

Claims 29 and 36 are not obvious variants of the invention claimed or disclosed in Insley '412 because of the differences between them and the Insley patent:

1. No disclosure in Insley '412 of a gas permeable, water impermeable layer comprising microporous layer coated with gas permeable polymeric coating (required by claim 29). Although Insley '412 may disclose the genus of fluid transport separation devices comprising a first layer having a structured surface with a plurality of flow channels and a selectively permeable fluid separation medium (e.g., microporous film) covering the flow channels, it does

not expressly disclose the sub-genus (of claim 29) in which the sheet covering the flow channels is gas permeable, water impermeable and coated with gas permeable polymeric coating, developed especially for application in membrane aerated biofilm reactors. and

2. No disclosure in Insley of a microbial population on the gas permeable, water impermeable layer (required by claim 36).

Because of these differences, claims 29 and 36 are patentably distinct from Insley '412, and obviousness-type double patenting is inapplicable.

Claim 54 has been amended by incorporating the limitations formerly in claim 55, to various means of imparting a hydrophilic property to the microbial support layer. Since a layer characterized by such a hydrophilic property is not disclosed in Insley, the rejection under obviousness-type double patenting has been avoided.

Claim 32 has been amended to independent form to overcome the objection in part 13 of the Office Action. Claim 39 has been amended to depend from claim 32. As amended, both claims 32 and 39 should be allowable.

In view of the above discussion, it is respectfully submitted that claims 29, 32, 34-36, 38-42, 54, 56 and 57, as amended, are in condition for allowance. Withdrawal of the rejections under 35 U.S.C. 102 and 103 and the doctrine of obviousness-type double patenting is requested and a notification of allowability is respectfully solicited. If any issues or questions remain the resolution of which the Examiner feels would be advanced by a conference with Applicants' attorney, she is invited to contact such attorney at the telephone number noted below.

Respectfully submitted,

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Date

By: Douglas B. Little
Douglas B. Little, Reg. No.: 28,439
Telephone No.: (651) 733-1501

Office of Intellectual Property Counsel
3M Innovative Properties Company
Facsimile No.: 651-736-3833

U.S.S.N. 10/017632	Insley et al. WO 00/44472 (US 6280824)	Jensvold et al. US 6153097
Claim 38 a. at least one gas permeable, water impermeable layer		
b. gas delivery layer proximate layer of part a. that provides means to convey gas to layer of part a.	contoured film, Figs 1-4, col. 3, ll. 46-59	
gas permeable water impermeable layer is oleophobic & has		
i) fluorochemical or fluoropolymer coating; ii) surface treated by ionizing radiation or plasma discharge in presence of fluorinated species; iii) fluorochemical additive; or iv) polydimethylsiloxane coating	fluorochemical additive col. 6, ll. 35-41	
Claim 40 gas delivery layer is porous and gas permeable		Col. 8, ll. 3-8
Claim 41 gas delivery layer comprises foams, woven or non-woven fabric		
Claim 42 & 54 gas delivery layer comprises base having side with plurality of walls forming flow channels through which gas can be conveyed to layer of part a.	Figs 1-4, col. 3, ll. 46-59	
Claim 54 ≥1 microbial support layer on side of layer of part a. opposite the gas delivery layer, said microbial support layer being hydrophilic, having:		
i) been exposed to reactive species in ion sheath generated in reaction chamber having grounded electrode and an RF electrode; ii) coating of hydrophilic polymer; iii) hydrophilic polymer chains grafted to microbial support layer; iv) surface active additive having hydrophilic group incorporated into polymer of polymeric microbial support layer; or v) been made of micro-fibers having sheath of hydrophilic polymer or hydrophilic surface active additive		
Claim 56 filler selected from Markush group – peat, coke, charcoal, etc.	activated carbon filler col. 4, l. 63, col. 6, l. 51	
Claim 57 microbial support layer carries net positive surface charge	charged media col. 5, l. 46-col. 6, l. 4., but not microbial support	

U.S.S.N. 10/017632	Insley et al. US 6514412 (WO 99/65595)	Rinker et al. US 4333779	Cote et al. US 6558549
Claim 29 a. gas permeable water impermeable layer comprising microporous layer coated with gas permeable polymeric coating			
gas delivery layer b. comprises base having side on which plurality of walls	contoured film, Figs 1-4, col. 3, ll. 46-59		
form plurality of flow channels through which gas can be conveyed to layer of part a	contoured film, Figs 1-4, col. 3, ll. 46-59		
Claim 36 microbial population on layer of part a			
Claim 54 microbial support layer on side of gas permeable, water impermeable layer opposite the gas delivery layer having	multiple layers of media 72 and 74 Fig. 4, col. 6, ll. 4-10, not disclosed as micro-bial support layer		
i) been exposed to reactive species in ion sheath generated in reaction chamber having grounded electrode and an RF electrode; ii) coating of hydrophilic polymer; iii) hydrophilic polymer chains grafted to microbial support layer; iv) surface active additive having hydrophilic group incorporated into polymer of polymeric microbial support layer; or v) been made of micro-fibers having sheath of hydrophilic polymer or hydrophilic surface active additive			